Installation and Operations Manual

INVOLAR MAC250 Microinverter

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Read This First

Before installing the MAC250 microinverter, please read this manual carefully to prevent injury to people and damage to the equipment.

Safety Icons

Please read the following safety symbols that indicate dangerous conditions and important safety instructions.

DANGEROUS	**DANGEROUS** **The DANGEROUS icon in this manual and on MAC250 Microinverters indicates a situation where failure to follow instructions may cause serious injuries or death.**

WARNING	**WARNING** **The WARNING icon indicates safety and hazards to people and equipment. This icon is used to call your attention to instructions for your personal safety and/or that of others. Use safety precautions to prevent injury to people and damage to equipment.**

NOTE	**NOTE** **The NOTE icon in this manual indicates important product information.**

1 Safety Instructions

For INVOLAR microInverter Warranty Terms and Conditions, refer to the appendix of this manual.

- Ensure that only qualified personnel should install and/or replace INVOLAR Microinverters.
- Comply with the rules of correct usage of tools and personal protective equipment (PPE) in order to ensure the safe running of INVOLAR Microinverters.
- Even if the inverter is not in running condition, the power input and output lines may still be of a dangerously high voltage. Break the circuit and wait for more than 15 minutes to ensure that the inverters have discharged to a safe low-voltage, and then start the installation.
- Before connecting the INVOLAR microinverter to the electrical utility grid, obtain approval from the utility company
- If the installation is carried out during the daytime, use opaque cover to block sunlight from the PV panels, eliminating the risk of exposing installers to lethal high-voltage.

WARNING	WARNING Be aware that the input AC voltage of the INVOLAR microinverter should not exceed 50V. Higher voltage may cause permanent damage to the device. If such damages occur, INVOLAR does not bear any warranty obligations nor any joint liability.

2 The INVOLAR MicroInverter System Instruction

2.1 The INVOLAR Microinverter System

The four key elements of an INVOLAR Microinverter System are:

- The INVOLAR microinverter
- The INVOLAR ETU communication gateway
- The INVOLAR SEDAS web-based monitor and analyzer
- PV panel

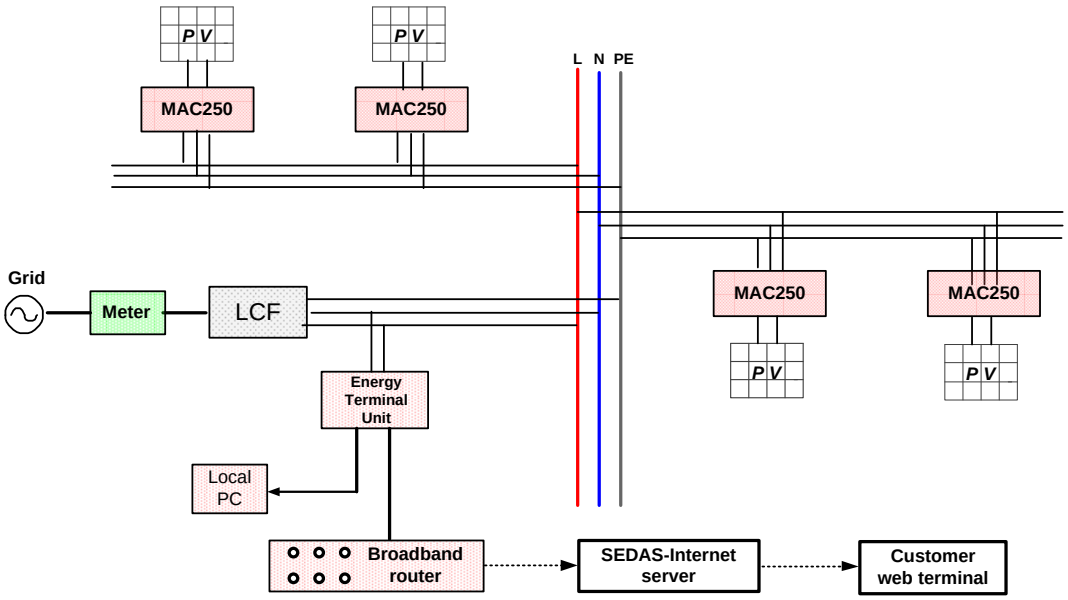


Figure 2-1 INVOLAR Microinverter System Diagram

NOTE	**NOTE** The INVOLAR ETU (Energy Terminal Unit) communication gateway, the INVOLAR LCF (Line Communication Filter), and the INVOLAR SEDAS (Solar Energy Data Acquisition System) are optional elements. Before installing these elements, read all instructions and cautionary markings in their corresponding user manuals.

3 INVOLAR Microinverter Installation

3.1 INVOLAR MAC250 Microinverter Operational Condition in PV System

PV Panel

The maximum PV Panel open circuit voltage CANNOT be more than 50V.

The range of PV panel output power is 180W-250W.

Electrical Utility Grid Connection

Connect the INVOLAR microinverter to the electrical utility grid only after obtaining prior approval from the utility company. The grid conditions must be met as specified in the following table before the microinverter system can operate properly.

Table 3-1 Parameters of Power Grid

Type	Rated Value	Variation Range
Voltage	220V	- 15%～ + 10%
Frequency	50Hz	±0.5Hz

Connection cable

The diameter of the connection cable should match the basic current capacity.

3.2 Installation Steps

INVOLAR MAC250 Microinverter Exterior Dimensions

Dimensions are shown in Figure 3-1 below.

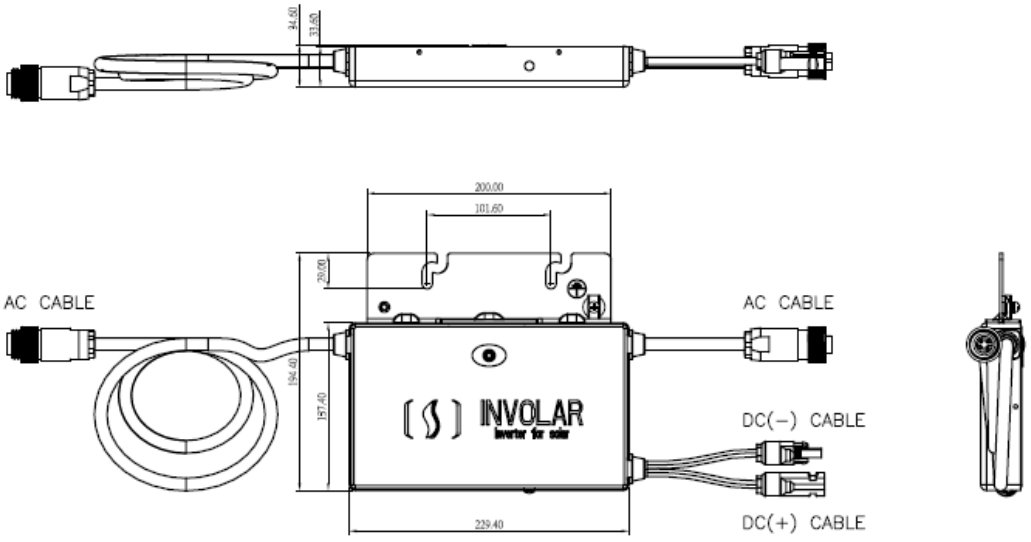


Figure 3-1 INVOLAR MAC250 Microinverter Dimensions

NOTE	NOTE • Leave enough space around the microinverter. • Allow a distance of 350mm between two microinverters.

Detailed Installation Procedures

Installation instructions in the following sections are referenced in Figure 3-2 below.

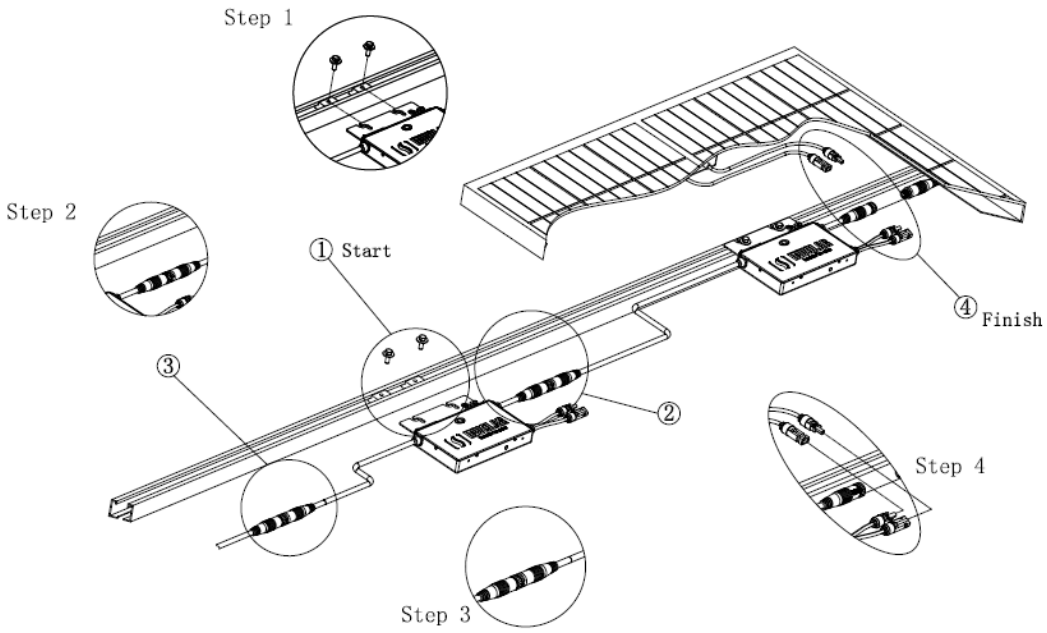


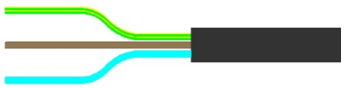
Figure 3-2 MAC250 Microinverter Detailed Installation Diagram

DANGEROUS	**Dangerous** • Only qualified personnel should install or maintain the INVOLAR microinverters to the electrical utility grid. • DO NOT connect INVOLAR microinverters to the utility grid or energize the AC circuit(s) until all installation procedures have been completed.
WARNING	**WARNING** • Ground the microinverters for safety purposes. • Comply with rules of correct usage of tools and personal protective equipment (PPE) for ensuring the safe installation of the microinverters.
NOTE	**NOTE** Micronverter's DC input and AC output power cables must be isolated from each other. Do not put them in the same cable tray or cable rack.

Follow the installation steps below (refer to Figure 3-2 above):

① Attach the INVOLAR microinverters to the racking with the male connector facing the junction-box;
② Connect the INVOLAR microinverter's left-hand side cable to the right-hand side cable of the microinverter to the left;
③ Connect the INVOLAR microinverter right-hand side cable to the left-hand side cable of the microinverter to the right (if the microinverter is the last one, cover the cable end with the protective cap);
④ Connect the INVOLAR microinverter to the PV panel;
⑤ Repeat step 2 through Step 4 until all the microinverters in a branch are connected.

Table 3-2 DC Output Cable

Yellow/Green - Unused Brown - L Light Blue - N			PIN 1 - Brown PIN 2 - Unused PIN 3 - Light Blue PIN 4 - Unused

NOTE

Note

The MAC250 microinverter DC connectors are standard plug-in components, thus they should match the connectors on the PV panels.

4 Function Instructions

4.1 Working Modes

The working modes of an INVOLAR microinverter are:

- Startup
- Active
- Fault
- Standby

The detailed working modes are described below.

Startup

Startup mode refers to the period for a newly installed INVOLAR microinverter. The system would only enter the startup mode if AC and DC cables are properly connected and the whole PV system is grounded.

Active

When the microinverter is in its normal operation process, this mode ensures that the power available from each PV panel is exported to the utility grid.

Fault

If the PV system does not operate correctly, the INVOLAR microinverter would stop automatically and enter into “Fault” mode. The INVOLAR microinverter system would continue to analyze the fault information. The INVOLAR microinverter remains in “Standby” mode until the fault is detected and eliminated. If the inoperative microinverter has been repaired and matched to the electrical utility grid, the whole INVOLAR microinverter system would enter operation mode after 20 seconds to 5 minutes. Beware that only qualified personnel should maintain the INOVLAR microinverters.

Standby

The microinverter is in “standby” mode when the microinverter is in operation process but maintains a low voltage and current in DC for a certain time. The microinverter manages to transition from “Active” to “Standby”. In “Standby” mode, the microinverters would continuously detect the energy output of the PV panels. When the output energy reaches the power generation conditions, the inverter would enter the “Active” mode from the “Standby” state.

NOTE	**NOTE** The INVOLAR microinverter cannot enter into “Standby” or “Active” mode when the PV panels are insufficiently operative during night time and rainy days.

4.2 Grid Connection

INVOLAR MAC250 microinverter system connects to the grid automatically. It detects and monitors the performance of each PV panel in the PV array. When the output energy reaches the power generating conditions, the INVOLAR MAC250 microinverter system would connect to the grid and generate electricity.

In the process of grid connection and electricity generation, the Maximum Peak Power Point Tracker (MPPT) function controls each PV panel individually so as to achieve maximum power havest.

4.3 Grid Disconnection

If the grid cannot meet the following conditions (Figure 6-1), the INVOLAR microinverter will stop operating.

Figure 6-1 Parameter of Power Grid

Type	Rated	Variation Range
Voltage	220V	187V～242V
Frequency	50Hz	49.5Hz～50.5Hz

5 Monitoring and Troubleshooting

5.1 Overview

The application of power line communication (PLC) technology in the INVOLAR MAC250 microinverter helps users monitor and detect the whole PV system via the internet. The SEDAS (Solar Energy Data Acquisition System) developed by INVOLAR tracks in real-time the statistics information of energy harvest for all INVOLAR microinverters in the array and monitors every panel's performance.

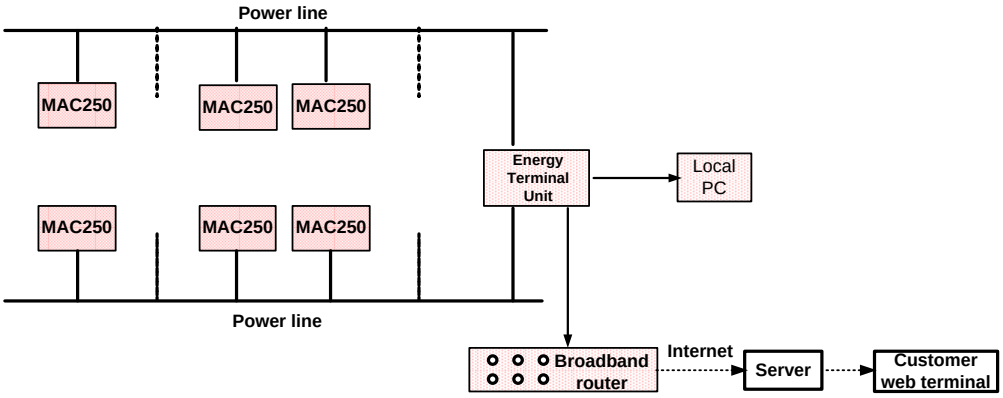


Figure 5-1 MAC250 Microinverter Communication System

5.2 MAC250 MICROINVERTER Status LED Indications and Error Reporting

One can access the INVOLAR MAC250 microinverter system LED menu to view and manage the operation conditions. The following (Table 5-1) shows the MAC250 MICROINVERTER Status LED indications and error report.

Table 5-1 MAC250 MICROINVERTER Status LED Indications and Error Reporting

LED Operation	Working Mode
2 short yellow blinks	startup
Flashing yellow continuously	Producing power and communicating with ETU
4 short yellow blinks	Producing power and not communicating with ETU
6 short yellow blinks	Fault
3 short yellow blinks	Standby

5.3 Intelligent Local PC and Internet Monitoring

The INVOLAR ETU collects performance information for each solar panel in a user's system and transmits this data to the INVOLAR DATA center and displays it on SEDAS website (see Diagram 5-1), where users can view and manage the PV panels' performance (see Diagram 7-2) of their solar power system (see Figure 5-2).

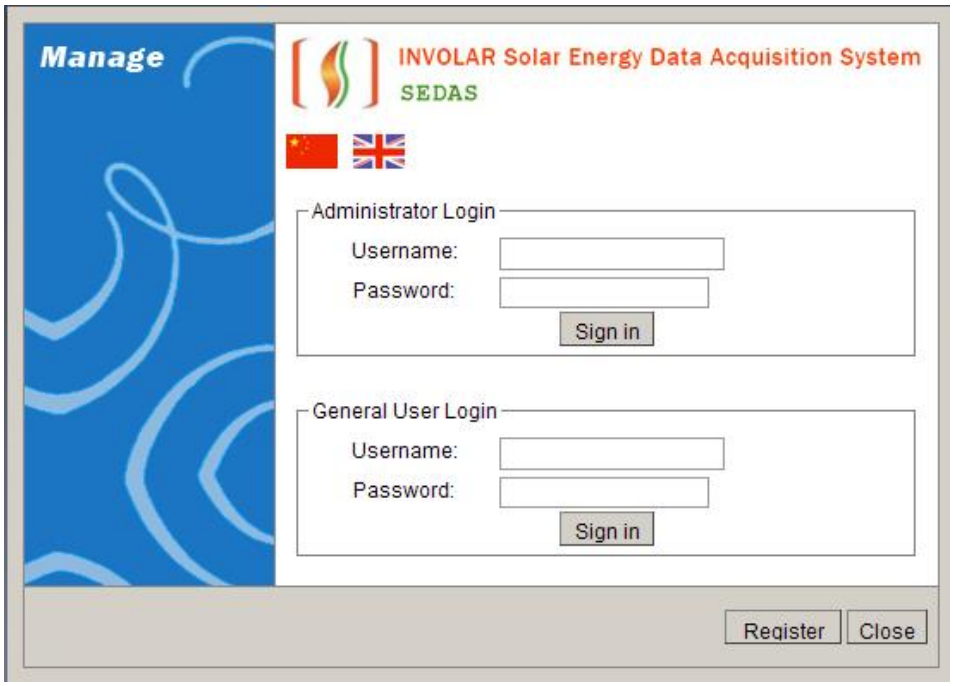


Figure 5-2 SEDAS Login Interface

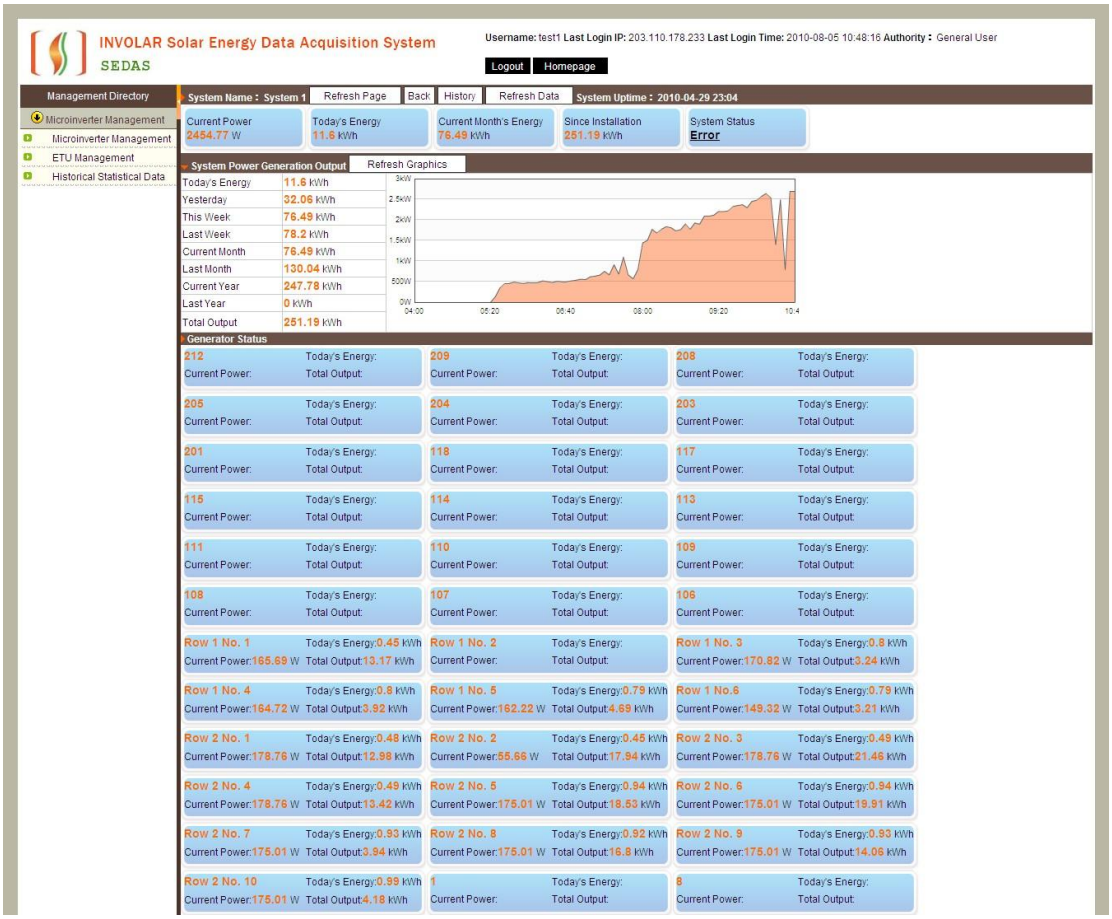


Figure 5-3 Performance of Each PV Panels in INVOLAR Microinverter System

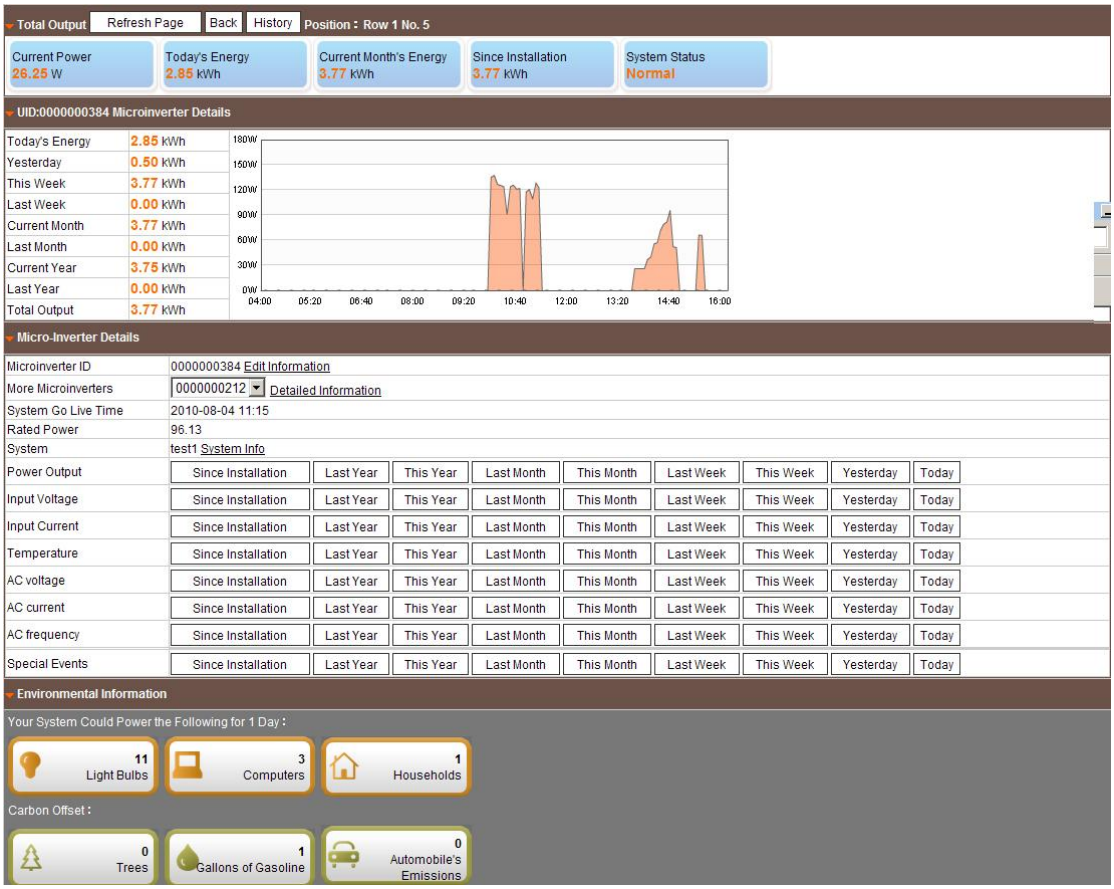


Figure 5-4 Statistics of Power Generation

Table 5-2 Detailed Controls

Fields	Explanation	Unit
Grid Voltage	Grid Voltage	V
Grid Current	Export AC	A
Grid Frequency	Grid Frequency	Hz
DC input voltage	DC input voltage	V
DC	Input DC	A
Power	Output Power	W
Temperature	Ambient temperature	℃
Module Temperature	MAC250 Module Temperature	℃
Daily Working Hours	Working Hours for the day	Minute
Daily power generation	Power Generation for the day	kWh
Monthly power generation	Power generation for the month	kWh
Total power generation	Total amount of power generation	kWh
Total working hours	Total amount of working hours	Hour

Table 5-3 Fault Mode

Fields	Explain
Module Disabled	MAC250 panel disabled in the PV system
Overheating	MAC250 overheating in the PV system
Over DC current	PV panel's output DC current too high
Over DC voltage	PV panel's output DC voltage too high
Over AC voltage	Voltage of the grid is too high
Under AC voltage	Voltage of the grid is too low
Abnormal Frequency	Abnormal frequency in the grid
Island effect	Anti-island protection

NOTE

A faulty microinverter does not affect the operation of other INVOLAR microinverters in the system. The rest of the panels and microinverters in the system will continue to operate.

WARNING	**WARNING** • Ensure that only qualified personnel should troubleshoot the PV array or the INVOLAR microinverter. • Never disconnect the DC wire connectors under loaded condition. Ensure that no current is flowing in the DC wires prior to disconnecting.

6 INVOLAR MAC250 MicroInverter Technical Data

6.1 Technical Specifications

Model	MAC250
Input Data (DC)	
Maximum input DC power	180W～250W
Maximum input DC voltage	50V
MPPT voltage range	22V～40V
Maximum DC input current	10A
Output Data (AC)	
Rated AC output Power	180W
Maximum AC output Power	220W
Rated AC output current	0.82A
Maximum AC output current	1A
AC output voltage range	187V～242V
AC output frequency range	49.5Hz～50.5Hz
Power factor	0.99
Total Harmonic Distortion	<4%
Maximum units per branch	16
Efficiency	
Peak inverter efficiency	95.0%
CEC weighted efficiency	94.0%
Nighttime power consumption	100mW
Mechanical Data	
Enclosure environmental rating	IP65
Operating temperature range	-25°C～+65 °C
Dimensions (WxHxD)	230mm/138mm/35mm
Weight	2.4kg
Features	
Communication	Power line
Compliance	CQC (TUV expected shortly)
Warranty	15 Years

7 Appendix

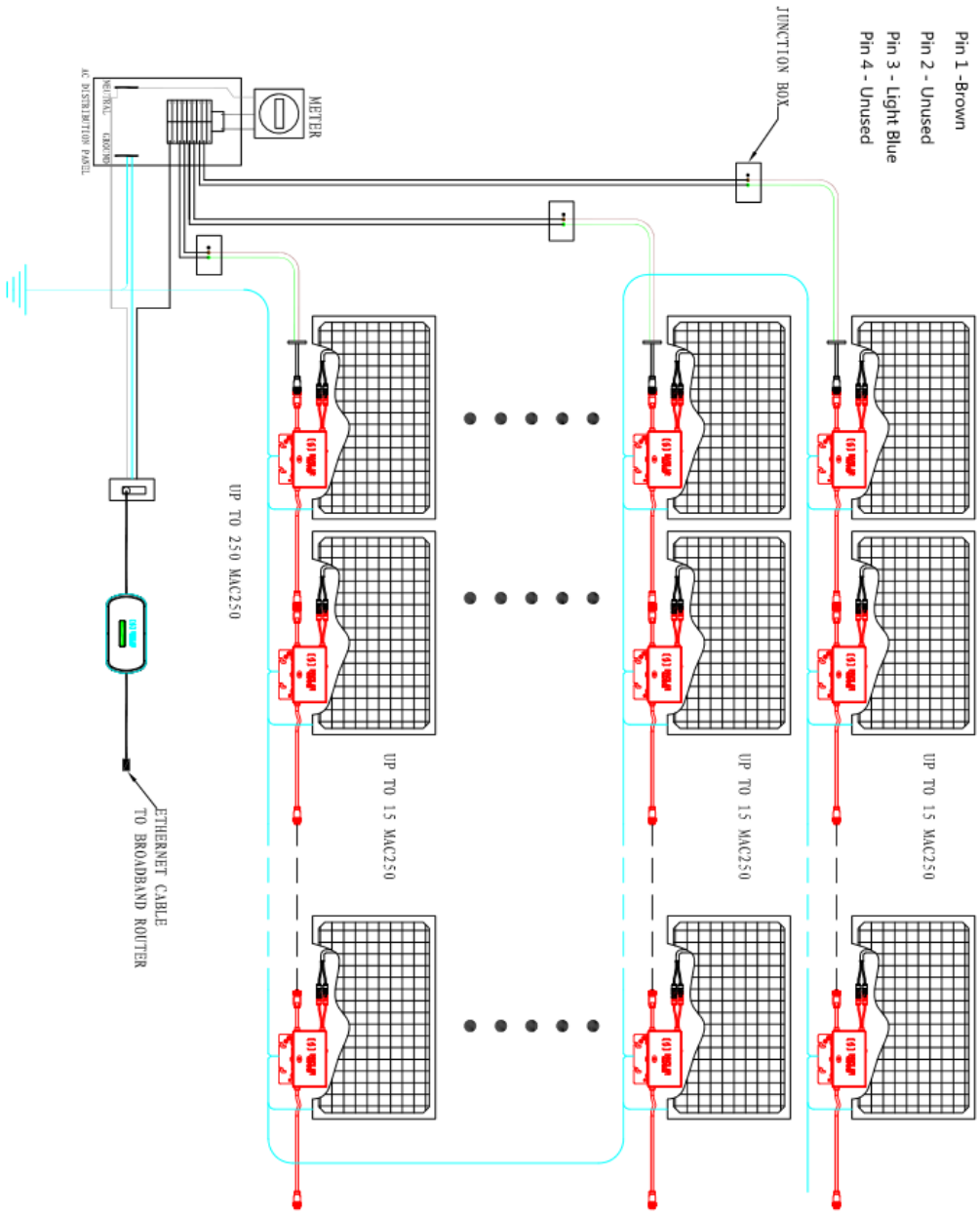
7.1 Limited Warranty

INVOLAR provides a 15-year warranty (The exact time depends on the contract). During the warranty period, if any defect in workmanship and materials of the INVOLAR microinverters is detected, the customer is entitled to a replacement or repairing at no cost.

The Limited Warranty does not cover products of which the INVOLAR trademark is not visible.

The Limited Warranty does not cover the following situations:

- Improperly installed
- Improperly operated
- Improperly handled or used
- Used under conditions in which the product is not designed for, or used in an unsuitable environment.
- Any installation or use beyond the scope of relevant international standards.
- Damage cause by abnormal natural environment.

The exact product dimensions and technical data depend on the latest released version. Change may occur without prior notice.

7.2 INVOLAR MAC250 MicroInverter System Sample Wiring Diagram